What is claimed is:

1. A method for improving a treatment for a bone-associated pathology in a mammal, which treatment comprises administering a chemotherapeutic agent and TBI to the mammal, comprising replacing the TBI with the administration of an amount of a complex comprising a radionuclide and a bone targeting ligand sufficient to deliver about 20 to about 60 Gy to the bone marrow of the mammal.

2. A therapeutic method to increase the efficacy of a chemotherapeutic treatment for a bone-associated pathology in a mammal comprising administering to the mammal, a chemotherapeutic agent and an amount of a complex comprising a radionuclide and a bone targeting ligand sufficient to deliver about 20 to about 60 Gy to the bone marrow of the mammal; wherein the efficacy of the chemotherapeutic treatment is increased without a substantial increase in at least one side effect, and wherein the mammal is not subjected to TBI in conjunction with the chemotherapeutic treatment.

3. The method of claim 1 or 2 further comprising the prior steps of administering a dosimetry dose of said radionuclide complex and determining the percent of the radionuclide that localizes to the bone of said mammal to determine a therapeutic dose for the radionuclide complex.

4. The method of claim 3 wherein the dosimetry dose comprises about 30-50 mci of said radionuclide.

5. The method of claim 1 or 2 wherein the administration of the chemotherapeutic agent and the complex does not produce substantially more side effects than the admnistration of the chemotherapeutic agent alone.

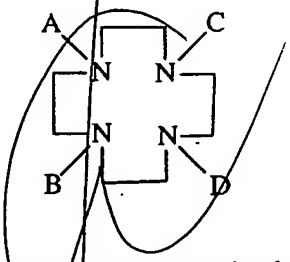
6. The method of claim 1 or 2 wherein the administration of the chemotherapeutic agent and the complex does not produce substantially more side effects than the admnistration of the chemotherapeutic agent and TBI.

7. The method of claim 1 or 2 wherein the chemotherapeutic agent is administered after administration of the complex.

8. The method of claim 1 or 2 further comprising administering an effective amount of GM-CSF or G-CSF to said mammal after bone marrow suppression is achieved.

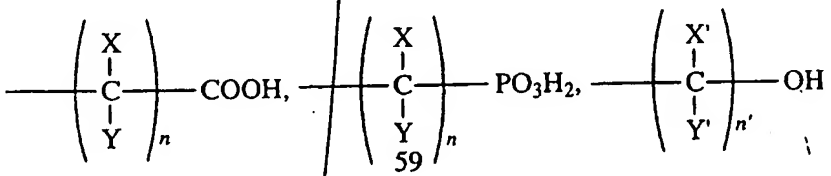
9. The method of claim 1 or 2 wherein the bone targeting ligand is a macrocyclic aminophosphonic acid.

10. The method of claim 9 wherein the macrocyclic aminophosphonic acid is of the formula:



wherein substituents A, B, C, and D are independently selected from hydrogen, hydrocarbon radicals having from 1-8 carbon atoms,

and physiologically acceptable salts of the acid radicals wherein X and Y are independently selected from the group consisting of hydrogen, hydroxyl, carboxyl, phosphonic, and hydrocarbon radicals having from 1-8 carbon atoms



and physiologically acceptable salts of the acid radicals, and n is 1-3 with the proviso that when n > 1, each X and Y may be the same as or different from the X and Y of any other carbon atom; X′ and Y′ are independently hydrogen, methyl, or ethyl radicals, and n′ is 2 or 3, with the proviso that at least two of said nitrogen substituents is a phosphorus containing group.

11. The method of claim 1 or 2 wherein the radionuclide is ^{67}Cu, ^{77}As, ^{77}Lu, ^{99}Mo, ^{105}Rh, ^{115}Cd, ^{122}Sb, ^{149}Pr, ^{193}Os, ^{198}Au, ^{200}Th, ^{153}Sm, ^{90}Y, ^{159}Gd, ^{186}Re, ^{188}Re or ^{166}Ho.

12. The method of claim 1 or 2, wherein said ligand is selected from the group consisting of ethylenediaminetetramethylenephosphonic acid (EDTMP), diethylenetriaminepentamethylenephosphonic acid (DTPMP), hydroxyethyl-ethylenediaminetrimethylenephosphonic acid (HEEDTMP), nitrilotrimethylene-phosphonic acid (NTMP), 1,4,7,10-tetraazacyclododecanetetramethylene-phosphonic acid (DOTMP), and tris(2-aminoethyl)aminehexamethylenephosphonic acid (TTHMP).

13. The method of claim 1 or 2, wherein the mammal is a human.

14. The method of claim 13, wherein about 2000-3000 MBq/kg is administered.

15. The method of claim 1 or 2 further comprising transplanting bone marrow or stem cells into a human after sufficient bone marrow suppression is achieved.

16. The method of claim 15 further comprising transplanting autologous bone marrow or stem cells into a human following purging cancerous cells from the bone marrow or stem cells prior to the transplanting step.

17. The method of claim 1 or 2, wherein the mammal is afflicted with cancer and the dose is effective to treat said cancer.

18. The method of claim 17, wherein the cancer is leukemia, lymphoma, multiple myeloma, metastatic breast cancer, metastatic prostate cancer, Hodgkin's disease, Ewing's sarcoma, osteosarcoma, non-Hodgkin's lymphoma, germ cell tumor, lung cancer, ovarian cancer, renal cell carcinoma, melanoma, or myelodysplastic syndrome.

19. The method of claim 17, wherein the cancer is a cancer comprising bone metastasis.

20. A method of treating a bone-associated cancer or non-cancerous disorder of bone marrow comprising administering to a human subject afflicted with said cancer or disorder an effective amount of a macrocyclic aminophosphonate ^{166}Ho complex in combination with an effective high dosage amount of a chemotherapeutic agent, wherein said amounts are effective to suppress the cancer cells or bone marrow cells of said mammal, and wherein said treatment does not substantially increase a side effect associated with the treatment with said chemotherapeutic agent used alone.

21. The method of claim 20 wherein the method is not carried out in conjunction with TBI.

22. The method of claim 20, wherein said amount of complex delivers about 30-50 Gy to the bone marrow of said human subject.

23. The method of claim 20 or 22 further comprising the prior steps of administering a dosimetry dose of said ^{166}Ho complex and determining the percent of said ^{166}Ho localized to the bone of said mammal.

24. The method of claim 20, wherein said aminophosphonate is 1,4,7,10-tetra-azacyclododecanetetramethylene-phosphonic acid (DOTMP).

25. The method of claim 20, further comprising transplanting bone marrow or stem cells into the mammal after sufficient ablation is achieved.

26. The method of claim 20, wherein a single dose of radionuclide is administered.

27. The method of claim 26, wherein said dose is administered within about 0.1-4 hours.

28. The method of claim 26, wherein said dose is administered as a single infusion or injection.

29. The method of claim 20, wherein the human is afflicted with cancer.

30. The method of claim 29 wherein the cancer is multiple myeloma.

31. The method of claim 20 or 30, wherein melphalan is administered at a dose of at least about 200 mg/m^2.

32. The method of claim 29, wherein the cancer is a cancer with bone metastasis.

33. The method of claim 32 wherein the cancer is metastatic breast cancer or metastatic prostate cancer.

34. The method of claim 29, wherein the cancer is leukemia, lymphoma, breast cancer, prostate cancer, Hodgkin's disease, Ewing's sarcoma, osteosarcoma, non-Hodgkin's lymphoma, germ cell tumor, ovarian cancer, renal cell carcinoma, melanoma, or myelodysplastic syndrome.

35. The method of claim 20, wherein the complex is administered in a liquid dosage form comprising an effective antiradiolytic amount of a radioprotectant.

36. A method for treating bone-associated cancer, wherein said method comprises administering to a human in need of such treatment an effective bone marrow suppressing dosage of ^{166}Ho-1,4,7,10-tetraazacyclododecane-tetramethylene-phosphonic acid (DOTMP) complex wherein the ratio of DOTMP to ^{166}Ho is above about 3; wherein said dosage delivers from about 20-60 Gy to the bone marrow of said human.

37. The method of claim 36 which does not comprise TBI.

38. The method of claim 36 wherein the cancer is prostate cancer.

39. The method of claim 36, 37, or 38 which does not comprise administration of a chemotherapeutic agent.

40. The method of claim 39 wherein the cancer is prostate cancer and wherein a chemotherapeutic agent is also administered.

41. The method of claim 40 wherein the agent is an anti-androgen.

42. The method of claim 40 wherein local radiotherapy is also administered.

43. The method of claim 36, wherein about 30-50 Gy is delivered to the bone marrow.

44. The method of claim 36 wherein the cancer is breast cancer.

45. The method of claim 44 wherein a chemotherapeutic agent is also administered.

46. The method of claim 44 wherein hematopoietic growth factors are also administered.

47. The method of claim 36, wherein the dosage contains about 2000-3000 MBq/kg of body weight of said mammal.

48. The method of claim 36 or 43 wherein a single dosage of complex is administered.

49. The method of claim 36 wherein the molar ratio of DOTMP to ^{166}Ho is about 3.5-4:1.

50. A method for treating infectious diseases in or near bone wherein said method comprises administering to a mammal in need of such treatment a dosage of a radionuclide complexed with a bone targeting ligand, or a physiologically acceptable salt thereof; wherein from about 250 to about 3000 megabecquerels per kilogram of body weight of the radionuclide is administered.

51. The method of claim 50, wherein said infectious disease is selected from the group consisting of osteochondritis, osteomyelitis, soft tissue infection, tuberculous osteomyelitis, osteochondritic syphilis, mycotic osteomyelitis, and periostic syphilis.

52. A method for treating noncancerous diseases in or near bone wherein said method comprises administering to a mammal in need of such treatment a dosage of a radionuclide complexed with a bone targeting ligand, or a physiologically acceptable salt thereof; wherein from about 250 to about 3000 megabecquerels per kilogram of body weight of the radionuclide is administered, without use of TBI.

53. A method of claim 52, wherein the disease is polycythemia vera, macroglobulinemia (Waldenstrom syndrome), megakaryocytic myelosis, or malignant histiocytosis.

54. The method of any one of claims 50, 51, 52, or 53 wherein the radionuclide is ^{153}Sm, ^{90}Y, ^{159}Gd, ^{186}Re, ^{188}Re, or ^{166}Ho.

55. The method of claim 54, wherein the radionuclide is ^{166}Ho.

56. The method of any one of claims 50, 51, 52, or 53 wherein about 2000 to about 3000 megabecquerels per kilogram of body weight of the radionuclide is administered.

57. A method for suppressing bone marrow or treating a bone marrow-associated pathology comprising administering an aqueous pharmaceutical composition to a human in need of such suppression or treatment, wherein said

composition comprises an effective amount of a complex of ^{166}Ho with 1,4,7,10-tetraazacyclododecane-tetramethylenephosphonic acid (DOTMP), wherein the mole ratio of DOTMP to ^{166}Ho is above 3, and an effective stabilizing amount of a radioprotectant, so that the composition is stable for at least about 72 hours under ambient conditions.

58. The method of claim 57 wherein the composition delivers about 20-60 Gy of ^{166}Ho to the bone marrow of the human.

59. The method of claim 57 wherein the ratio of DOTMP to ^{166}Ho is about 3.5-5:1.

60. The method of claim 57, 58, or 59 wherein the composition is administered as a single dose.

61. The method of claim 60 wherein the dose is administered within about 4 hours.

62. The method of claim 57 wherein the radioprotectant is ascorbic acid.

63. The method of claim 57 wherein the bone marrow-associated pathology is cancer.

64. The method of claim 63 wherein the cancer is multiple myeloma.

65. The method of claim 64 further comprising administering at least about 200 mg/m^2 of melphalan to said human.

66. The method of claim 57 wherein the cancer is metastatic prostate cancer or metastatic breast cancer.

67. The method of claim 57, 64, or 66 further comprising administering targeted radiation or TBI to said human.

68. The method of claim 66 further comprising administering a chemotherapeutic agent to said human.

69. The method of claim 67 wherein the agent is administered after complex is administered.

70. The method of claim 57 further comprising the steps of administering a dosimetry dose of ^{166}Ho-DOTMP to said human and determining the percent distribution of ^{166}Ho to the bone of said human.

71. A liquid pharmaceutical composition comprising ^{166}Ho complexed with 1,4,7,10-tetraazacyclododecanetetramethylene-phosphonic acid (DOTMP) in a mole ratio of DOTMP to ^{166}Ho above 3; and an effective antiradiolytic amount of a pharmaceutically acceptable radioprotectant.

72. The composition of claim 71, wherein the radioprotectant is ascorbic acid or gentisic acid.

73. The composition of claims 71 or 72 wherein the ratio of DOTMP to ^{166}Ho is about 3.5-5.

74. The composition of claim 71, comprising an aqueous carrier adjusted to pH 7-8.

75. The composition of claim 71 comprising about 35-75 mg ascorbic acid/ml of composition.

76. The composition of claim 71 which is stable for at least 72 hours under ambient conditions.

77. A method to treat metastatic prostate cancer in a human in need of such therapy comprising administering to the mammal an effective dose of the composition of claim 71.

78. The method of claim 77 further comprising subjecting the mammal to local radiation therapy.

79. A method to treat metastatic breast cancer in a human in need of such therapy comprising administering to the human an effective dose of the composition of claim 71.

80. A method for treating a patient afflicted with a hematopoietic genetic defect wherein said method comprises administering to a mammal in need of such treatment a bone marrow suppressing dosage of a radionuclide complexed with a bone targeting ligand, or a physiologically acceptable salt thereof; wherein from about 250 to about 3000 megabecquerels per kilogram of body weight of the radionuclide is administered and; administering a therapeutic gene to said patient.

81. The method of claim 80 wherein a transgenic stem cell comprising a recombinant normal human gene is administered to the pateint following suppression of the bone marrow.

82. The method of claim 79 wherein the composition is administered in conjunction with a combination of cyclophosphamide, thiotepa and carboplatin.

83. The method of claim 1 or 2 wherein the bone-associated pathology is metastatic breast cancer and the chemotherapeutic agent is cyclophosphamide, thiotepa, carboplatin or a combination thereof.

84. The method of claim 32 wherein the cancer is breast cancer and the chemotherapeutic agent is cyclophosphamide, thiotepa, carboplatin or a combination thereof.

85. The method of claim 44 or 68 wherein the chemotherapeutic agent is cyclophosphamide, thiotepa, carboplatin or a combination thereof.